Versar inc.

MEMORANDUM

TO: Laura Casey

cc: 11.1126.2000.001
Jim Buchert

FROM: Diane Sinkowski, Mike Koontz

DATE: August 1, 2005

SUBJECT: Review of Clariant/BBL Response to Versar Request for Additional Information/Calculations (June 20, 2005)

Per your technical directive (July 11, 2005), Versar has reviewed Clariant's response to Versar's request to provide additional calculations showing the relative contributions of different exposure routes (ingestion, dermal absorption, and inhalation) to the total dose estimates. The requested information was provided by Clariant in an Excel spreadsheet named "forward calcs2_7.5.xls". Additionally, the spreadsheet included risk-based carpet concentrations based on a retention factor (RF) of 1.0, where all the PCBs in the carpeting are volatilized. The calculations now present a range of bioavailability factors (BioAFs) and RFs that include the worst-case scenario of a BioAF of 1.0 and an RF of 1.0. All the calculations have been verified (an example is provided in Attachment 1). The only problem found with the calculations is that the weekly air exchange rate (AE) used, 126, is noted as being based on an hourly AE rate of 0.35/hr, but is actually based on the original higher AE rate of 0.75/hr. The weekly AE rate based on 0.35/hr would be 58.8. During our conference call on June 16th, it was agreed that a lower AE of 0.35/hr or, at the very least, the typical or average value of 0.45 AEs per hour, as given in the *Exposure Factors Handbook*, corresponding to a weekly AE of 75.6 should be used. The risk-based carpet concentrations for an AE of 0.75 provided in the spreadsheet are shown in Table 1. The target total PCB carpet concentrations associated with an AE of 0.35/hr are presented in Table 2.

From a comparison of Tables 1 and 2, it is apparent that changing the AE rate from 0.75/hr to 0.35/hr makes a substantial difference only when the RF is 1.0. With an RF of 1.0, the inhalation route accounts for more than half of the total lifetime cancer risk and the total hazard index (see the above-referenced spreadsheet). To obtain some insight on an appropriate value for the RF, we performed an alternative calculation using a mass-balance approach, calculating a steady-state or average concentration in lieu of that calculated using the volatilization factor. For the mass-balance approach, it was assumed that all tPCB mass in the carpet was released, at a constant rate, over its 10-year lifetime (details on the calculation can be provided on request). The results from the two approaches were similar only if a larger value (in the range of 0.1 to 1.0) was used for the RF when making the calculation using the volatilization factor.

Table 1. Risk-based Concentrations (mg/kg) of tPCBs in Carpet Fiber (for AE = 0.75/hr.)

Oral Bioavailability Factor	Acceptable Concentration in Carpet Fiber (mg tPCB/kg)			
	Retention Factor			
	0.001	0.005	0.01	1.00
Non-Cancer Hazard				
0.01	133	122	111	5.8
0.05	81	77	72	5.6
0.10	54	52	50	5.4
0.50	15	15	15	4.3
1.00	7.9	7.8	7.8	3.4
Cancer Risk				
0.01	664	610	554	29
0.05	404	384	361	28
0.10	271	262	251	27
0.50	75	74	73	22
1.00	39	39	39	17

Table 2. Risk-based Concentrations (mg/kg) of tPCBs in Carpet Fiber (for AE = 0.35/hr.)

Oral Bioavailability Factor	Acceptable Concentration in Carpet Fiber (mg tPCB/kg)			
	Retention Factor			
	0.001	0.005	0.01	1.00
Non-Cancer Hazard				
0.01	129	109	91	2.7
0.05	80	71	63	2.7
0.10	54	50	46	2.7
0.50	15	15	14	2.4
1.00	7.8	7.8	7.7	2.1
Cancer Risk				
0.01	647	546	457	14
0.05	398	357	317	14
0.10	269	250	229	13
0.50	75	73	71	12
1.00	39	39	38	10

As discussed in the conference call, there is a high degree of uncertainty associated with the oral BioAF and, especially, the RF. Although in reality it is probable that ingested PCBs are not all bioavailable, EPA has not yet reviewed the available data and provided a recommendation. Similarly, some amount of PCBs may be retained in the carpeting, although, as discussed in the uncertainty section of the April 11, 2005, submission, some empirical data exist. Some assumed exposure parameters do introduce conservatism to the calculations. Such assumptions include a child exposure for 350 days a year for 10 years or a carpet fiber ingestion rate of 55 mg/day. Ideally, a small-chamber test for a time period such as 30 days to fit a time-varying emission profile to the data should be conducted. This profile then could be used as a basis for estimating the fraction of tPCBs in the carpet that ultimately would be emitted over its 10-year life.

Additionally, if a BioAF and an RF, other than the worst-case scenario is to be assumed, the target risk could be modified to a lower (i.e., more stringent) value as a safety factor.

Please feel free to contact us if you have any questions.

Attachment 1
Verification of Noncancer Calculations in "forward calcs2_7.5.xls"
(for Carpet Concentration = 133 mg/kg)

Ingestion = (Conc * IR * Bio * ED * EF * 0.000001) / (ATnc * BW) / RfD

Parameter	Value	Explanation
Conc	133	Carpet concentration (mg/kg) (multiply by 0.000001 to get kg/kg or fraction)
IR	55	Dust (soil) ingestion rate (mg/day)
Bio	0.01	Bioavailablity factor (unitless)
ED	10	Exposure duration (carpet life; yrs)
EF	350	Exposure frequency (days/yr)
ATnc	3650	Averaging time for noncarcinogens (days)
BW	21.8	Body weight (children 6 months to 12 yrs old; kg)
RfD	0.00002	Reference Dose

HQ = (133*55*0.01*10*350*0.000001) / (3650*21.8) / 0.00002 = 0.16 or **1.6E-01**

Dermal = (Conc * SA * AF * Derm * ED * EF * 0.000001) / (ATnc*BW) / RfD

Parameter	Value	Explanation
Conc	133	Carpet concentration (mg/kg) (multiply by 0.000001 to get kg/kg or fraction)
SA	2763	Contact skin surface area during warm-weather play with 32% skin exposed (cm^2/day)
AF	0.00724	Soil adherence factor for children post-activity indoors on hands, arms, legs, feet (mg/cm2)
DERM	0.14	Dermal uptake factor (US EPA)
ED	10	Exposure duration (carpet life; yrs)
EF	350	Exposure frequency (days/yr)
ATnc	3650	Averaging time for noncarcinogens (days)
BW	21.8	Body weight (children 6 months to 12 yrs old; kg)
RfD	0.00002	Reference Dose

HQ = (133*2763*0.00724*0.14*10*350*0.000001) / (3650*21.8) / 0.00002 = 0.82 or **8.2E-01**

Inhalation = (Conc * IHR * 1/VF * RF * ED * EF) / (ATnc*BW) / RfD

Parameter	Value	Explanation
Conc	133	Carpet concentration (mg/kg) (multiply by 0.000001 to get kg/kg or fraction)
IHR	10.42	Inhalation rate (m^3/day)
VF (m^3/kg) = $[d_w (m)*10^{3.83-0.62\log VF}]/[Mass_c(mg/m2)/1000000 (mg/kg)]/AE$ = 137745.1		
RF	0.001	Retention Factor (unitless)
ED	10	Exposure duration (carpet life; yrs)
EF	350	Exposure frequency (days/yr)
ATnc	3650	Averaging time for noncarcinogens (days)
BW	21.8	Body weight (children 6 months to 12 yrs old; kg)
RfD	0.00002	Reference Dose

HQ = (133*10.42*1/137745.1*0.001*10*350) / (3650*21.8) / 0.00002 = 0.022 or **2.2E-02**